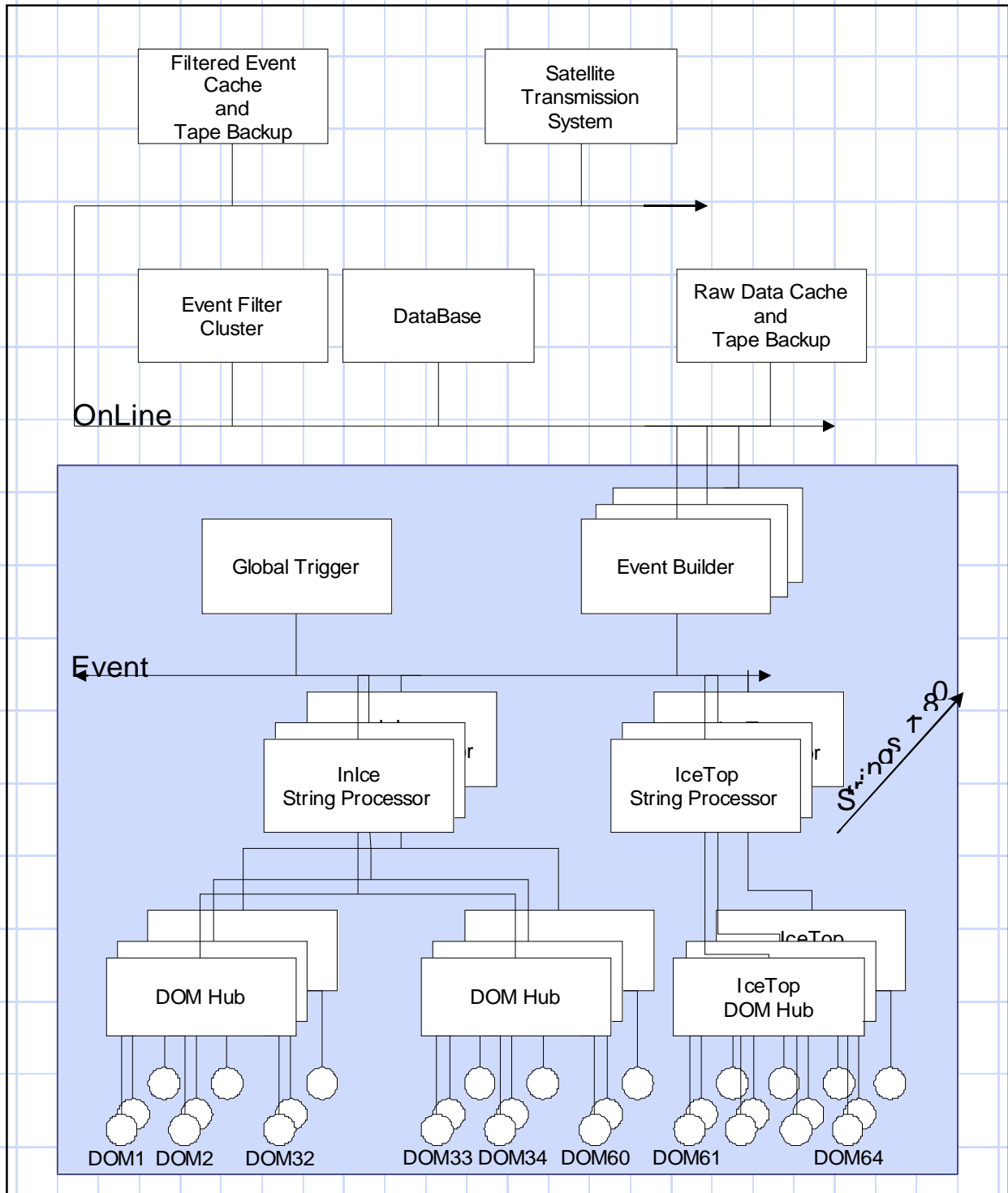
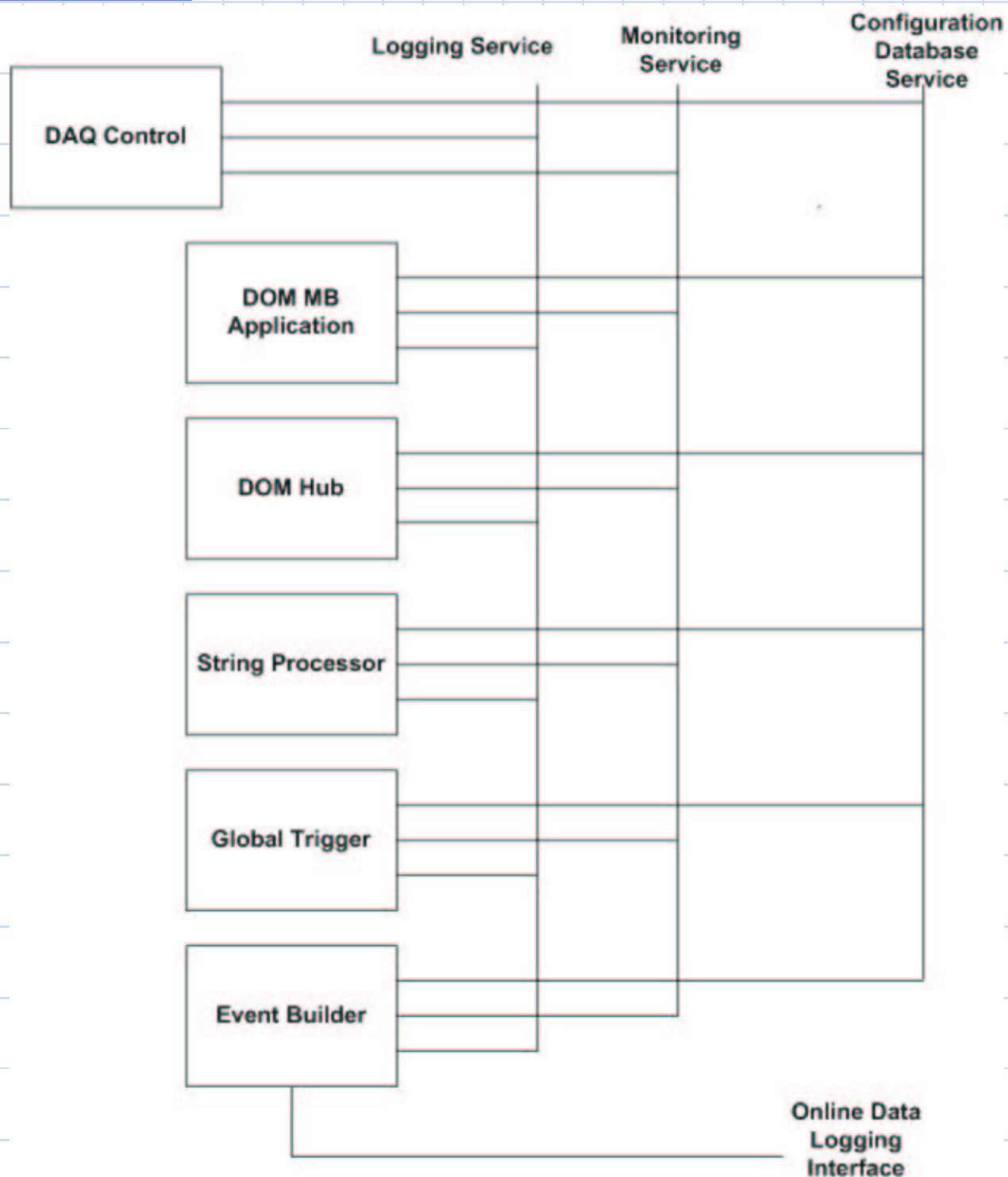


IceCube DAQ: “DOM MB to Event Builder”



DAQ Design Components:



DAQ Control:

- ◆ Provides single control view of all DAQ components.
 - Single access point for control and monitoring of overall DAQ state.
 - Sequencing of individual DAQ components into requested operational state.
 - Periodic monitoring of individual DAQ components.
 - Automated DAQ-wide response to exceptions and error conditions.

DOM MB Application:

❖ DOM resident software responsible for configuring and executing data acquisition activities in the DOM.

Control of all DOM resident hardware functions.

Download, storage and execution control of all programs and firmware.

Control of all waveform digitization, compression and data buffering functions.

Control of all communications and data transport functions between the DOM and surface subsystems.

DOM Hub:

- ◆ As sole DOM attachment point, provides all DOM related control and communications functions.
- Nexus for all attached DOM communications functions.
- Management of cable power and individual DOM operational state.
- Provides continuous data collection from attached DOMs.
- Manages periodic time calibration operations.
- Forwards collected DOM data, time calibrations and DOM monitoring information to associated string processor.
- Collects and forward monitoring information.

String Processor:

◆ First DAQ component responsible for examining DOM data and extracting hit information.

▮ Provides data buffering for an entire string for a configurable time interval.

▮ Applies time corrections to individual DOM data streams.

▮ Extracts hit synopses from DOM data stream.

▮ Forwards hit synopsis to global trigger.

▮ Upon request, forwards DOM data for a specified interval to event builder.

▮ Collects and forward monitoring information.

Global Trigger:

- ◆ Maps individual string hit synopses onto detector wide events of interest.
 - ┌ Collects individual string hit synopses.
 - ┌ Once synchronized to a given time frame, searches for detector wide events.
 - ┌ Communicates time intervals of interest to all string processors and event builder.
 - ┌ Collects and forward monitoring information.

Event Builder:

- ◆ Collects time interval contributions from all string processors and create detector wide data records.
 - ▮ Collects global trigger requests to build icecube events.
 - ▮ Collects and synchronize contributions from all string processors.
 - ▮ Passes built events to online data logging interface.
 - ▮ Collects and forward monitoring information.



Dataflow characteristics:

- ◆ Data compression and event rejection necessary for full data rate operation.
- ◆ Everything beyond DOM MB operates as lossless, flow controlled process.
- ◆ Two “synch” frames in data path:
 - Global trigger hit synopsis input.
 - Event builder data stream input.
- ◆ Single point for possible data loss- ATWD/DOM MB application data buffer (i.e. inside DOM).
 - Data losses tagged and monitored by DOM Hub data engine.
 - When data losses occur, tends to keep data streams for all DOMs current and overlapping in time.

Control Flow:

- ◆ Once properly configured, control propagates with data.
- ◆ Synchronization points implemented by network messaging.
- ◆ Exceptions accommodated :
 - Missing data replaced by token (e.g. stalled string processor).
 - Malfunctioning component causes DAQ control to shutdown DAQ (e.g, stalled global trigger).

Configuration Control:

◆ Flexibility is key to test facility setup and efficient string integration @pole.

◆ Configuration overview.

▮ All components self-configure per configuration database-typically at beginning of data or test run.

▮ DOM Hub: determine DOMs present, verify their internal config. matches DB,...

▮ Each SP: verify active in DB, determine which DOMs active, verify active DOMs present...

▮ GT: determine which SP's active....

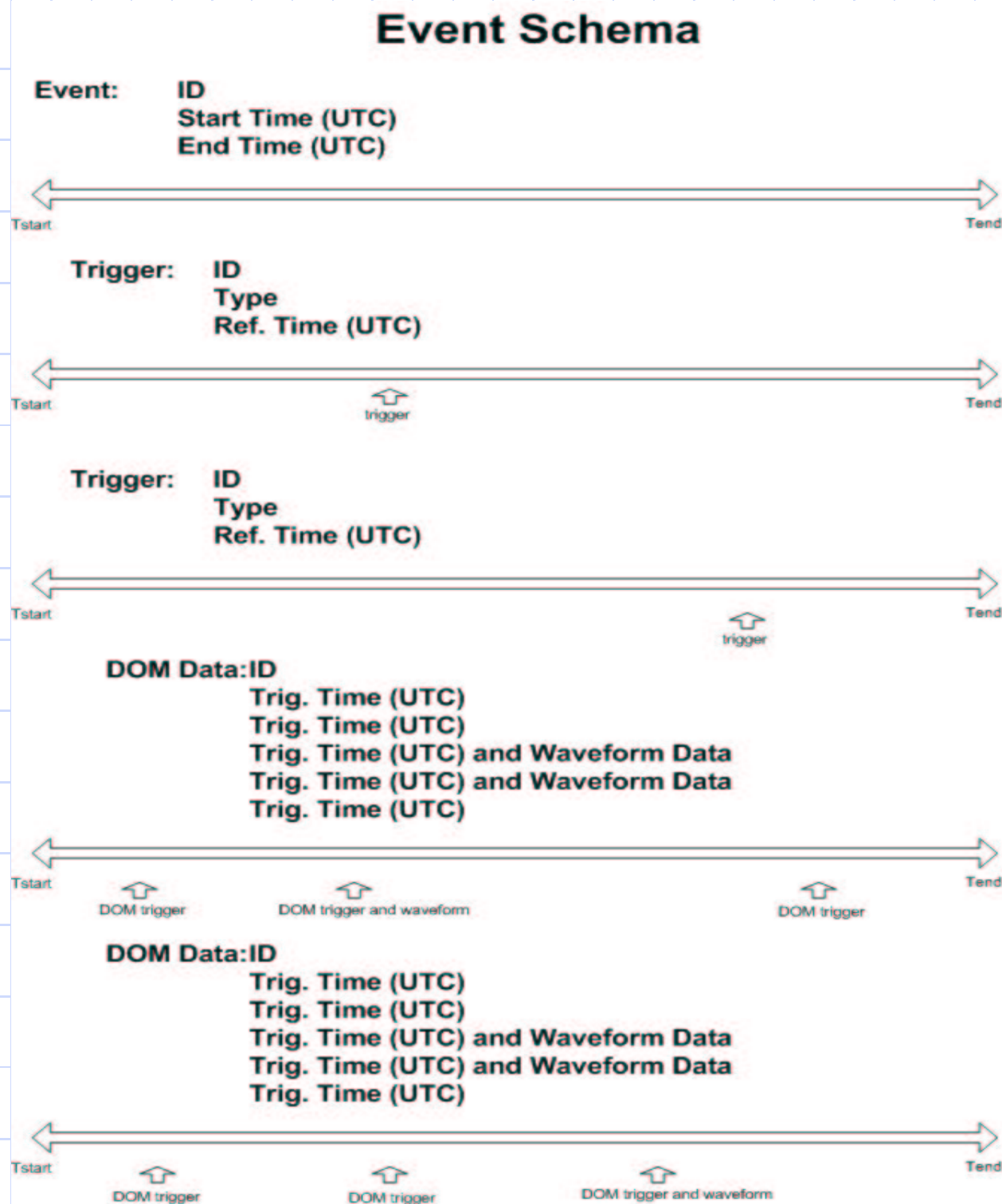
▮ EB: determine which SP's active...

▮ User control interfaces to DB not individual DAQ components.

Key Data Structures:

- ◆ DOM MB engineering event
Presently w/o allowance for data compression or feature extraction.
- ◆ String Hit Synopsis (TBD)
- ◆ String Data Stream (TBD)
- ◆ Event Builder Output
(Candidate).

IceCube Event Schema:



DOM Engineering Format:

◆ DOM Application Data Formats



◆ **Format Name:** Raw engineering event.

◆ **Format Description:** Event containing all data presented by the FPGA to the DOM application on a per event basis.



◆ **Field Name:** Event byte length.

◆ **Field Description:** Length of the entire event structure including this field.



◆ **Field Length:** 16 bits.

◆ **Comments:** This may differ from the data length reported to the DOM application by the FPGA firmware.



◆ **Field Name:** Event format identifier.

◆ **Field Description:** Fixed value flag word that identifies format type for this data record.



◆ **Field Length:** 8 bits.

◆ **Comments:** Value is fixed for all data records of this format. Exact value to be determined.



◆ **Field Name:** Flasher trigger flag.

◆ **Field Description:** Flag that indicates local LED flasher operation co-incident with ATWD discriminator threshold crossing.



◆ **Field Length:** 1 bit.

◆ **Comments:**

Event Builder Format:

IceCube Data Structure: A Strawman Proposal

D. Cowen, G. Sullivan

27 October 2002

Revision 4

EVENT RECORD

This record type

Version number of this record

Run number

Event number

Global Trigger data

Trigger type

Trigger time (GPS)

Trigger variables

Raw data structure

IN-ICE

Number of tubes hit

Trigger time

Trigger type/trigger mask

For each hit tube:

Tube number

Type of hit (SPE or complex
waveform)

Start time

L(ATWD) [length of ATWD information]

ATWD digitization 1

ATWD digitization 2

ATWD digitization N

L(FADC) [length of FADC
information]

FADC digitization

FADC digitization 2